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SEQUENCE LISTING

<110> BASF Plant Science GmbH

<120> Delta-4-Desaturases from Euglena gracilis, expressing plants and PUFA comprising oils

<130> 20030192

<160> 2

<170> PatentIn version 3.1

<210> 1
<211> 1626
<212> DNA
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<223> Delta-4-Desaturase

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1               5                   10                  15

aac ggc aag ccg gag aac gga gcc acc cct gag aac gga gcg aag ccg       96
Asn Gly Lys Pro Glu Asn Gly Ala Thr Pro Glu Asn Gly Ala Lys Pro
            20                  25                  30

caa cct tgc gag aac ggc acg gtg gaa aag cga gag aat gac acc gcc      144
Gln Pro Cys Glu Asn Gly Thr Val Glu Lys Arg Glu Asn Asp Thr Ala
        35                  40                  45

aac gtt cgg ccc acc cgt cca gct gga ccc ccg ccg gcc acg tac tac      192
Asn Val Arg Pro Thr Arg Pro Ala Gly Pro Pro Pro Ala Thr Tyr Tyr
    50                  55                  60

gac tcc ctg gca gtg tcg ggg cag ggc aag gag cgg ctg ttc acc acc      240
Asp Ser Leu Ala Val Ser Gly Gln Gly Lys Glu Arg Leu Phe Thr Thr
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65                  70                  75                  80

gat gag gtg agg cgg cac atc ctc ccc acc gat ggc tgg ctg acg tgc      288
Asp Glu Val Arg Arg His Ile Leu Pro Thr Asp Gly Trp Leu Thr Cys
                85                  90                  95

cac gaa gga gtc tac gat gtc act gat ttc ctt gcc aag cac cct ggt      336
His Glu Gly Val Tyr Asp Val Thr Asp Phe Leu Ala Lys His Pro Gly
            100                 105                 110

ggc ggt gtc atc acg ctg ggc ctt gga agg gac tgc aca atc ctc atc      384
Gly Gly Val Ile Thr Leu Gly Leu Gly Arg Asp Cys Thr Ile Leu Ile
        115                 120                 125

gag tca tac cac cct gct ggg cgc ccg gac aag gtg atg gag aag tac      432
Glu Ser Tyr His Pro Ala Gly Arg Pro Asp Lys Val Met Glu Lys Tyr
    130                 135                 140

cgc att ggt acg ctg cag gac ccc aag acg ttc tat gct tgg gga gag      480
Arg Ile Gly Thr Leu Gln Asp Pro Lys Thr Phe Tyr Ala Trp Gly Glu
145                 150                 155                 160

tcc gat ttc tac cct gag ttg aag cgc cgg gcc ctt gca agg ctg aag      528
Ser Asp Phe Tyr Pro Glu Leu Lys Arg Arg Ala Leu Ala Arg Leu Lys
                165                 170                 175

gag gct ggt cag gcg cgg cgc ggc ggc ctt ggg gtg aag gcc ctc ctg      576
Glu Ala Gly Gln Ala Arg Arg Gly Gly Leu Gly Val Lys Ala Leu Leu
            180                 185                 190

gtg ctc acc ctc ttc ttc gtg tcg tgg tac atg tgg gtg gcc cac aag      624
Val Leu Thr Leu Phe Phe Val Ser Trp Tyr Met Trp Val Ala His Lys
        195                 200                 205

tcc ttc ctc tgg gcc gcc gtc tgg ggc ttc gcc ggc tcc cac gtc ggg      672
Ser Phe Leu Trp Ala Ala Val Trp Gly Phe Ala Gly Ser His Val Gly
    210                 215                 220

ctg agc atc cag cac gat ggc aac cac ggc gcg ttc agc cgc aac aca      720
Leu Ser Ile Gln His Asp Gly Asn His Gly Ala Phe Ser Arg Asn Thr
225                 230                 235                 240

ctg gtg aac cgc ctg gcg ggg tgg ggc atg gac ttg atc ggc gcg tcg      768
Leu Val Asn Arg Leu Ala Gly Trp Gly Met Asp Leu Ile Gly Ala Ser
                245                 250                 255

tcc acg gtg tgg gag tac cag cac gtc atc ggc cac cac cag tac acc      816
Ser Thr Val Trp Glu Tyr Gln His Val Ile Gly His His Gln Tyr Thr
            260                 265                 270

aac ctc gtg tcg gac acg cta ttc agt ctg cct gag aac gat ccg gac      864
Asn Leu Val Ser Asp Thr Leu Phe Ser Leu Pro Glu Asn Asp Pro Asp
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Val Phe Ser Ser Tyr Pro Leu Met Arg Met His Pro Asp Thr Ala Trp
    290                 295                 300

cag ccg cac cac cgc ttc cag cac ctg ttc gcg ttc cca ctg ttc gcc      960
Gln Pro His His Arg Phe Gln His Leu Phe Ala Phe Pro Leu Phe Ala
305                 310                 315                 320

ctg atg aca atc agc aag gtg ctg acc agc gat ttc gct gtc tgc ctc     1008
Leu Met Thr Ile Ser Lys Val Leu Thr Ser Asp Phe Ala Val Cys Leu
                325                 330                 335

agc atg aag aag ggg tcc atc gac tgc tcc tcc agg ctc gtc cca ctg     1056
Ser Met Lys Lys Gly Ser Ile Asp Cys Ser Ser Arg Leu Val Pro Leu
            340                 345                 350

gag ggg cag ctg ctg ttc tgg ggg gcc aag ctg gcg aac ttc ctg ttg     1104
Glu Gly Gln Leu Leu Phe Trp Gly Ala Lys Leu Ala Asn Phe Leu Leu
        355                 360                 365

cag att gtg ttg cca tgc tac ctc cac ggg aca gct atg ggc ctg gcc     1152
Gln Ile Val Leu Pro Cys Tyr Leu His Gly Thr Ala Met Gly Leu Ala
    370                 375                 380

ctc ttc tct gtt gct cac ctt gtg tcg ggg gag tac ctc gcg atc tgc     1200
Leu Phe Ser Val Ala His Leu Val Ser Gly Glu Tyr Leu Ala Ile Cys
385                 390                 395                 400

ttc atc atc aac cac atc agc gag tct tgt gag ttt atg aat aca agc     1248
Phe Ile Ile Asn His Ile Ser Glu Ser Cys Glu Phe Met Asn Thr Ser
                405                 410                 415

ttt caa acc gcc gcc cgg agg aca gag atg ctt cag gca gca cat cag     1296
Phe Gln Thr Ala Ala Arg Arg Thr Glu Met Leu Gln Ala Ala His Gln
            420                 425                 430

gca gcg gag gcc aag aag gtg aag ccc acc cct cca ccg aac gat tgg     1344
Ala Ala Glu Ala Lys Lys Val Lys Pro Thr Pro Pro Pro Asn Asp Trp
        435                 440                 445

gct gtg aca cag gtc caa tgc tgc gtg aat tgg aga tca ggt ggc gtg     1392
Ala Val Thr Gln Val Gln Cys Cys Val Asn Trp Arg Ser Gly Gly Val
    450                 455                 460

ttg gcc aat cac ctc tct gga ggc ttg aac cac cag atc gag cat cat     1440
Leu Ala Asn His Leu Ser Gly Gly Leu Asn His Gln Ile Glu His His
465                 470                 475                 480

ctg ttc ccc agc atc tcg cat gcc aac tac ccc acc atc gcc cct gtt     1488
Leu Phe Pro Ser Ile Ser His Ala Asn Tyr Pro Thr Ile Ala Pro Val
                485                 490                 495

gtg aag gag gtg tgc gag gag tac ggg ttg ccg tac aag aat tac gtc     1536
Val Lys Glu Val Cys Glu Glu Tyr Gly Leu Pro Tyr Lys Asn Tyr Val
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500 505 510

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Thr Phe Trp Asp Ala Val Cys Gly Met Val Gln His Leu Arg Leu Met
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ggt gct cca ccg gtg cca acg aac ggg gac aaa aag tca taa 1626
Gly Ala Pro Pro Val Pro Thr Asn Gly Asp Lys Lys Ser
530 535 540

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<213> Euglena gracilis

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Asn Gly Lys Pro Glu Asn Gly Ala Thr Pro Glu Asn Gly Ala Lys Pro
20 25 30

Gln Pro Cys Glu Asn Gly Thr Val Glu Lys Arg Glu Asn Asp Thr Ala
35 40 45

Asn Val Arg Pro Thr Arg Pro Ala Gly Pro Pro Pro Ala Thr Tyr Tyr
50 55 60

Asp Ser Leu Ala Val Ser Gly Gln Gly Lys Glu Arg Leu Phe Thr Thr
65 70 75 80

Asp Glu Val Arg Arg His Ile Leu Pro Thr Asp Gly Trp Leu Thr Cys
85 90 95

His Glu Gly Val Tyr Asp Val Thr Asp Phe Leu Ala Lys His Pro Gly
100 105 110

Gly Gly Val Ile Thr Leu Gly Leu Gly Arg Asp Cys Thr Ile Leu Ile
115 120 125

Glu Ser Tyr His Pro Ala Gly Arg Pro Asp Lys Val Met Glu Lys Tyr
130 135 140

Arg Ile Gly Thr Leu Gln Asp Pro Lys Thr Phe Tyr Ala Trp Gly Glu
145 150 155 160

Ser Asp Phe Tyr Pro Glu Leu Lys Arg Arg Ala Leu Ala Arg Leu Lys
165 170 175

Glu Ala Gly Gln Ala Arg Arg Gly Gly Leu Gly Val Lys Ala Leu Leu
180 185 190

Val Leu Thr Leu Phe Phe Val Ser Trp Tyr Met Trp Val Ala His Lys
195 200 205

Ser Phe Leu Trp Ala Ala Val Trp Gly Phe Ala Gly Ser His Val Gly
210 215 220

Leu Ser Ile Gln His Asp Gly Asn His Gly Ala Phe Ser Arg Asn Thr
225 230 235 240

Leu Val Asn Arg Leu Ala Gly Trp Gly Met Asp Leu Ile Gly Ala Ser
245 250 255

Ser Thr Val Trp Glu Tyr Gln His Val Ile Gly His His Gln Tyr Thr
260 265 270

Asn Leu Val Ser Asp Thr Leu Phe Ser Leu Pro Glu Asn Asp Pro Asp
275 280 285

Val Phe Ser Ser Tyr Pro Leu Met Arg Met His Pro Asp Thr Ala Trp
290 295 300

Gln Pro His His Arg Phe Gln His Leu Phe Ala Phe Pro Leu Phe Ala
305 310 315 320

Leu Met Thr Ile Ser Lys Val Leu Thr Ser Asp Phe Ala Val Cys Leu
325 330 335

Ser Met Lys Lys Gly Ser Ile Asp Cys Ser Ser Arg Leu Val Pro Leu

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            340                 345                 350

Glu Gly Gln Leu Leu Phe Trp Gly Ala Lys Leu Ala Asn Phe Leu Leu
        355                 360                 365

Gln Ile Val Leu Pro Cys Tyr Leu His Gly Thr Ala Met Gly Leu Ala
    370                 375                 380

Leu Phe Ser Val Ala His Leu Val Ser Gly Glu Tyr Leu Ala Ile Cys
385                 390                 395                 400

Phe Ile Ile Asn His Ile Ser Glu Ser Cys Glu Phe Met Asn Thr Ser
                405                 410                 415

Phe Gln Thr Ala Ala Arg Arg Thr Glu Met Leu Gln Ala Ala His Gln
            420                 425                 430

Ala Ala Glu Ala Lys Lys Val Lys Pro Thr Pro Pro Pro Asn Asp Trp
        435                 440                 445

Ala Val Thr Gln Val Gln Cys Cys Val Asn Trp Arg Ser Gly Gly Val
    450                 455                 460

Leu Ala Asn His Leu Ser Gly Gly Leu Asn His Gln Ile Glu His His
465                 470                 475                 480

Leu Phe Pro Ser Ile Ser His Ala Asn Tyr Pro Thr Ile Ala Pro Val
                485                 490                 495

Val Lys Glu Val Cys Glu Glu Tyr Gly Leu Pro Tyr Lys Asn Tyr Val
            500                 505                 510

Thr Phe Trp Asp Ala Val Cys Gly Met Val Gln His Leu Arg Leu Met
        515                 520                 525

Gly Ala Pro Pro Val Pro Thr Asn Gly Asp Lys Lys Ser
    530                 535                 540
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